of a family of his own he has adopted several children and is living a contented and happy life. He is so sure of his poise and tranquillity of mind that he contemplates having the function of the vasectomy restored, but the possibility of the transmissibility of so strong a heredity is a factor which must be given serious consideration.

We may conclude that: (1) So-called cures or arrests in essential epilepsies are brought about only by the most thorough-going and prolonged plan of neurologic and hygienic training treatment in which reëducation is the basic factor. (2) That relapses in arrested cases occur through negligence or disregard of the essential factors. There is renewed and intensive physical and mental stress and that proper and appropriate medical supervision should be continued throughout the lives of such individuals. Such a plan of after-care in private and institutional practice would greatly diminish the possibilities of relapses. (3) That a more or less enduring arrest and cure in essential epilepsy may be considered permanent when the environment and life reactions as regards the secondary epileptic reactions are approximately normal. That no mere cessation of epileptic fits under sedatives should be held out as an enduring arrest unless the individual shows a corresponding absence of epileptic reactions of all sorts.

VIRULENT DIPHTHERIA BACILLI CARRIED BY CATS.[1]

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The available literature dealing with the transmission of diphtheria from cats to human beings is not convincing, due chiefly to the fact that the bacteriologic studies and reports are incomplete. However, many instances are on record which apparently show a relationship between animal and human infections, based upon clinical observations alone.

Thirty years ago Klein[2] described lesions in cats which he considered typical of natural infections with diphtheria bacilli. Low,[3] in 1888, reported the occurrence of four cases of diphtheria in one house, which he thought had been carried by a pet cat from another case in the same neighborhood. Cultures from this cat contained morphologically typical diphtheria bacilli. Karlinski,[4] in 1908, published observations of an outbreak of diphtheria which resulted in the death of seventeen out of twenty-four Angora cats. He stated that typical pseudomembranous lesions were found from which he isolated virulent Klebs-Loeffler bacilli. He also reported a number of cases of diphtheria in children who were infected after contact with sick cats. In the same year Graham-Smith[5] made the following statement: "A general impression prevails that cats contract diphtheria from human subjects and very numerous instances are quoted in the literature of cats apparently suffering from diphtheria communicating it to children; and other examples are quoted of cats, although remaining quite well, being the only probable carriers of infection. Very few of these cases seem to have been bacteriologically examined, and in no instance has the presence of diphtheria bacilli been satisfactorily proved."

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[1] Published with permission of the Surgeon-General, U. S. Army, who is not responsible for any opinion expressed or conclusions reached herein.

[2] Local Government Board Report (Gr. B.), 1889, pp. 162–174.

[3] Ibid., 1888, xviii, 131.

The following case was brought to my attention in July, 1919, by Capt. W. C. Deming, M.C., U.S.A.:

Mrs. P., an elderly lady, who lived in Maryland, had been very ill with a "severe tonsillitis" for four days, when Capt. D. was asked to see her on July 13, 1919. Examination at that time showed that the patient's uvula, both tonsils and posterior pharynx were covered with a grayish-brown false membrane. She breathed with difficulty and appeared to be very weak. Ten thousand units of diphtheria antitoxin were given immediately and cultures were made from the pseudomembrane. In spite of treatment the patient died early the following morning. The culture, which was examined at the Walter Reed General Hospital laboratory, showed a luxuriant growth of diphtheria bacilli. These organisms killed guinea-pigs in six days after subcutaneous injection, but failed to produce lesions in animals previously injected intraperitoneally with diphtheria antitoxin.

Cat A. A pet cat, which often slept in the bed with Mrs. P. and was "constantly fondled by her," had been sick one week before the patient's illness began. The cat had a "croupy cough, was unable to swallow food, became very thin and cried continually." It was thought that a piece of chicken bone had become lodged in the animal's throat. The cough persisted until July 13, after which the cat appeared to be improving, although it was still quite thin. Throat cultures on July 14 showed bacilli which were morphologically similar to those obtained from the patient. The virulence for guinea-pigs of the two cultures was also the same. Two days later the cat was chloroformed and a careful postmortem examination was made. The only lesion found was a small oval ulceration covered with a yellowish-gray pseudomembrane, between two smaller red inflammatory areas on the upper surface of the left nasal fossa (Fig. 1). Neither the fatty degeneration of the kidneys described by Klein nor any other lesion of the internal organs was found. Cultures made from the nasal pseudomembranous lesion contained diphtheria bacilli.

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[4] Ueber eine durch Hauskatzen Verbreitete Diphtheritis-epidemie bei Kindern Heilkunde, Berlin. u. Leipzig, 1908, p. 129.

[5] The Bacteriology of Diphtheria (Nuttall and Graham-Smith), Chapter VII, p. 281.

Cat B. Throat cultures made of another cat which had often played with Cat A were positive July 18 for morphologically typical diphtheria bacilli. After confinement in a cage at the laboratory for eight days this cat died. At necropsy small, elongated, grayish-white patches of pseudomembrane were found covering ulcerations of the vocal cords. These were surrounded by a narrow red area (Fig. 2). Diphtheria bacilli, which killed guinea-pigs in four days, were isolated from these lesions. Diphtheria antitoxin protected guinea-pigs against this organism.

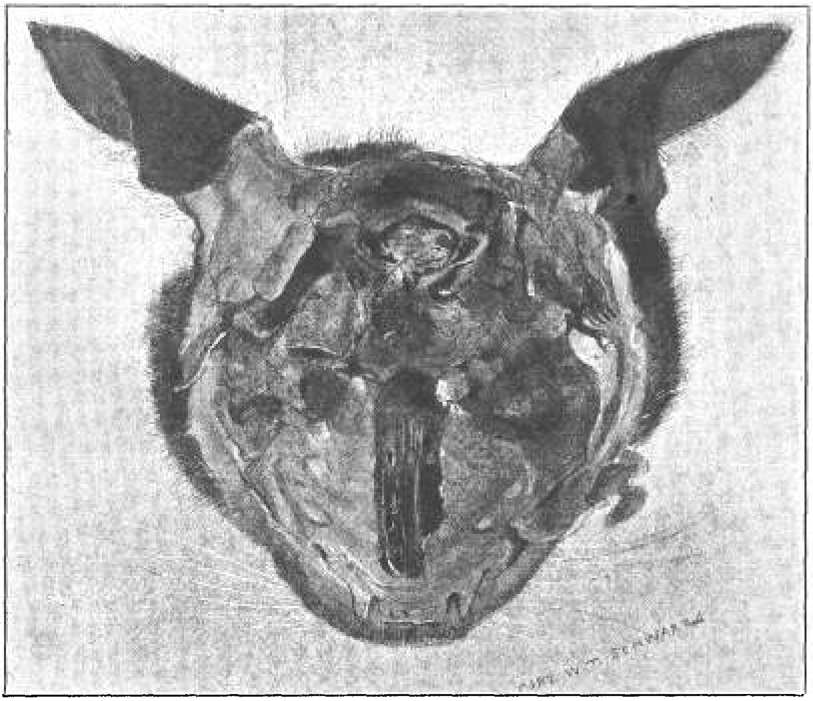

FIG. 1.—Nasal diphtheria. Cat A (specimen in Army Medical Museum, Washington, D. C.). The lower jaw has been removed and an opening made through the roof of the mouth into the nasal fossæ. Virulent diphtheria bacilli were isolated from the small oval lesion on the left.

Three stray cats caught on the hospital grounds and examined at this time were negative. A small, slender, granular, Gram-positive bacillus of the diphtheria group was obtained from the throat of Cat 1. However, it differed culturally from the true diphtheria bacillus and was not virulent for guinea-pigs. None of the control cats showed any pathologic lesion.

Bacteriologic Data. The organisms isolated from lesions of cats A and B and the patient, Mrs. P., showed the following common characteristics: Colonies were grayish-white, moist, confluent and non-adhesive after growing upon Loeffler's serum media at a temperature of 37.5° C. for twenty hours. After several days' incubation they became yellowish. There was no proteolytic action in cultures six weeks old. Granular bacilli similar to Wesbrook's types C and D, which were Gram-positive, Neisser-positive and not acid-fast predominated in smears from the younger colonies. In glucose infusion broth cultures a granular deposit was formed without clouding. Pellicle formation occurred. Small, round, moist, gray, non-hemolytic colonies were formed on horse-blood agar plates in twenty-four hours. A trace of acid without coagulation developed

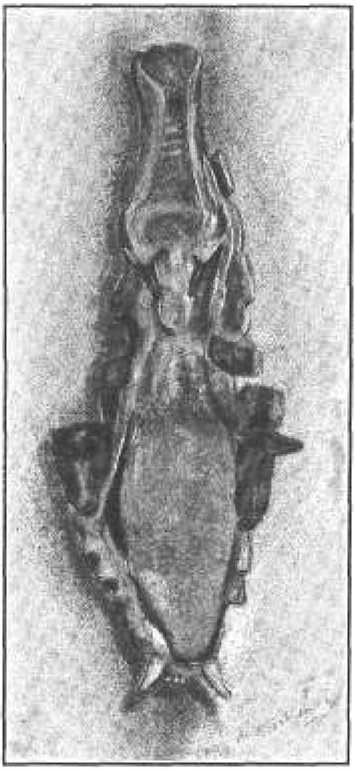

Fig. 2.—Laryngeal diphtheria. Cat B (specimen in Army Medical Museum Washington, D. C.) shows lower jaw, upper portion of the trachea and the larynx spread open. Virulent diphtheria bacilli were isolated from ulcerations on both vocal cords.

in litmus milk cultures. No indol was formed. Acid without gas was formed in glucose, maltose and dextrin; alkali in mannite and inulin, while no change in reaction occurred in lactose, xylose and arabinose broth cultures. Both cat cultures produced acid in saccharose while the patient's culture became alkaline. As the ability of diphtheria bacilli to ferment saccharose is extremely variable, this difference does not prove that the three strains were unrelated. For the determination of virulence, guinea-pigs weighing 300 grams each were inoculated subcutaneously with 1.5 c.c. of seventy-two hour broth cultures, and animals were examined as soon after death as possible. A similar dose was given to control guinea-pigs previously inoculated intraperitoneally with 100 units of diphtheria antitoxin. None of these control animals died. Cultures from Mrs. P. and from Cat A both killed pigs in six days, while the Cat B culture killed a pig in four days.

Source of culture.	Granular bacilli.	Days required to kill guinea-pig.	Control guinea-pig (diphtheria antitoxin).	Typical reaction to stains.	Typical characteristics on Loeffler's media and broth.	Acid production—carbohydrate media.								
						Glucose.	Saccharose.	Maltose.	Dextrin.	Inulin.	Mannite.	Lactose.	Xylose.	Arabinose.
Cat A became ill July 2; lesion left nasal; partial recovery; chloroformed July 16	Yes	6	Lived	Yes	Yes	Yes	Yes	Yes	Yes	No	No	0	0	0
Patient, Mrs. P., became ill July 9; lesion pharyngeal; died July 13	Yes	6	Lived	Yes	Yes	Yes	No	Yes	Yes	No	No	0	0	0
Cat B became ill, date unknown; lesions of vocal cord; died July 26	Yes	4	Lived	Yes	Yes	Yes	Yes	Yes	Yes	No	No	0	0	0
Positive control (National Vaccine Co. strain)	Yes	1½	Lived	Yes	Yes	Yes	No	Yes	Yes	No	No	0	0	0
Cat No. 1; negative control from post	Yes	Avirulent		Yes	No	Yes	No	Yes	Yes	No	No	0	0	0
Cat No. 2	No organisms of the diphtheria group found.													
Cat No. 3	No organisms of the diphtheria group found.													

Yes = acid. No = alkali. 0 = no change.

The organisms obtained from the throat culture of control Cat 1 was a small, slender, Gram-positive, non-acidfast granular bacillus. Colonies on coagulated serum media were yellowish, round, dry, adherent and emulsified very poorly. No proteolytic action was observed. Cultures had a disagreeable odor. A cloudy growth without pellicle formation occurred in glucose infusion broth cultures. Colonies on horse-blood agar plates were gray and very minute even after forty-eight hours' growth. Litmus milk was unchanged; no indol was formed in peptone cultures. Acid was formed in glucose, maltose and dextrin; alkali in saccharose, inulin and mannite, while no reaction occurred in lactose, xylose and arabinose broth cultures. This organism was not virulent for guinea-pigs.

The history of contact and the dates of infection, when considered with the bacteriologic findings, suggest that Cat A was the source of the diphtheritic infection developed by Mrs. P. as well as that of Cat B, but this cannot be proved, However, it is certain that both of these cats were infected carriers of virulent diphtheria bacilli and therefore a menace to human beings.

Summary. 1. An elderly lady developed a fatal diphtheritic pharyngitis after close contact with a cat (A) which had been sick one week.

2. A second cat (B) which had been in contact with the first cat (A) became sick and died ten days later.

3. The patient had a grayish-brown pseudomembrane covering her uvula, tonsils and posterior pharynx. Cat A had a small yellowish-gray pseudomembranous ulceration in the left nasal passage and Cat B showed ulcerations of both vocal cords, covered with a grayish-white false membrane.

4. Diphtheria bacilli of intermediate virulence for guinea-pigs were isolated from all three lesions.